WHAT IS CLAIMED IS:

1.   A road surface friction state estimating apparatus comprising:

        a self aligning torque estimating portion which estimates self
aligning torque applied to a tire;

        a slip angle estimating portion which estimates a slip angle of the
tire;

        a high pass filter which performs high pass filter processing on the
slip angle estimated by the slip angle estimating portion;

        a lateral force calculating portion which calculates a lateral force
applied to the tire;

        a slip angle converting portion which converts the lateral force
calculated by the lateral force calculating portion into a slip angle;

        a low pass filter which performs low pass filter processing on the slip
angle obtained by conversion by the slip angle converting portion;

        a summing portion which sums the slip angle on which the high pass
filter processing has been performed by the high pass filter and the slip angle on
which the low pass filter processing has been performed by the low pass filter; and

        a road surface friction state estimating portion which estimates a road
surface friction state based on the slip angle obtained by summation by the summing
portion and the self aligning torque estimated by the self aligning torque estimating
portion.

2.   The apparatus according to claim 1, wherein the high pass filter and
the low pass filter have the same breakpoint frequency.

3.   The apparatus according to claim 2, wherein a value of the
breakpoint frequency of the high pass filter and the low pass filter is set according to a
vehicle movement state.

4.   The apparatus according to claim 3, wherein the value of the
breakpoint frequency is set so as to be higher as a vehicle speed is higher.

5.   The apparatus according to claim 3, wherein the value of the breakpoint frequency is set so as to be higher as a deviation between the slip angle estimated by the slip angle estimating portion and the slip angle obtained by conversion by the slip angle converting portion is larger.

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6.   The apparatus according to claim 1, wherein a sum of a transfer function of the high pass filter and a transfer function of the low pass filter is 1.

7.   The apparatus according to claim 1, wherein the road surface friction

10   state estimating portion calculates a self aligning torque reference value based on the slip angle obtained by summation by the summing portion, and estimates a grip degree based on a ratio between the self aligning torque reference value and the self aligning torque estimated by the self aligning torque estimating portion.

15   8.   The apparatus according to claim 7, wherein the road surface friction state estimating portion estimates a road surface friction coefficient based on the grip degree and a lateral acceleration.

9.   The apparatus according to claim 8, wherein the road surface friction

20   state estimating portion estimates the road surface friction coefficient when the grip degree becomes equal to or smaller than a reference value.

10.   A road surface friction state estimating method comprising the steps of:

25   estimating self aligning torque applied to a tire;

estimating a slip angle of the tire;

performing high pass filter on the estimated slip angle;

calculating a lateral force applied to the tire;

converting the lateral force into a slip angle;

30   performing low pass filter processing on the slip angle obtained by conversion;

summing the slip angle on which the high pass filter has been performed and the slip angle on which the low pass filter has been performed; and

estimating a road surface friction state based on the slip angle obtained by summation and the estimated self aligning torque.